MODIS SCIENCE TEAM MEMBER
Semi- Annual (July 1993)

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a) Task Objectives

The objectives of this phase of the project were: to continue the research program developing the 'at-launch' algorithms for MODIS atmospheric correction, vegetation indices, fire detection and land cover and to build the infrastructure and collaboration to permit the research to be undertaken. The project has developed a number of collaborative projects which are intended to expand the scope of the team members activities and involve a larger community in the MODIS research. Due to the small number of researchers addressing the issues necessary for the methodological advances needed for MODIS, emphasis has been given to developing international collaborative research through the IGBP Data and Information System Core Project. In addition, preliminary results of the research were presented at key scientific meetings. The project was also represented at the MODIS Team meeting. Results of the project are in the process of being written up and submitted for publication.

b) Tasks Accomplished (Data analysis and interpretation).

Specifically the project has addressed the following topics over the last four months:

• MODIS Atmospheric Correction

-6S Code: Development of a procedure to integrate bi-directional response has been completed. Several BRDF models have been implemented (Pinty and Verstraete, Hapke, Roujean et al, Walthall et al) and testing has been performed. Integration of 'real' BRDF data from the Kimes (GSFC) data base is planned. The new 6S Code will be released for Beta Testing shortly. A paper describing the code is in preparation.

-Stratospheric Aerosol: analysis continues to evaluate the effect of stratospheric aerosols on AVHRR data. Collection of AVHRR data (visible and near- infrared) is underway to compute the Aerosol Optical Thickness (AOT) in both channels (.67micron, .87 microns),and improve the existing stratospheric aerosol model. The stratospheric aerosol model has been validated by analyzing spectral and directional dependence of path radiance observed over the Pacific Ocean. Validation using "stable" vegetated zones over Africa and pre-Pinatubo data shows the efficiency of stratospheric aerosol correction technique.

- Aerosol Retrieval: Aerosol measurements from Brazil collected using the Holben (GSFC) Sunphotometer Network have been used to test the Dense Dark Vegetation (DDV) aerosol retrieval method using AVHRR GAC data. AVHRR LAC scenes for GSFC have been selected to test the aerosol retrieval method (DDV and Contrast Reduction) using measurements from the prototype sunphotometer instrument. Aerosol AOT retrievals from AVHRR data collected over Brazil and for an ocean surface (Coast of Tasmania) have been validated using sun-photometer measurements. Theoretical work in the thermal infrared has been performed in order to validate the AVHRR-Channel 3 (3.75 micron) albedo computation used in the DDV algorithm. This development will also permit validation of the water vapor retrieval important for analysis of AVHRR-Channel 2 data. The analysis of more than one year of SSMI and AVHRR data over ocean was performed in order to establish a relation between the water vapor content and AVHRR Channel 4-Channel 5 with special attention being given to angular dependency. This study led to the development of a procedure for atmospheric correction over sea using AVHRR-Channel 2.

- Sun Photometer Aerosol Validation Activity: the operational version of the instrument that will be operating in Brazil and at the NSF LTER sites during 1993 and for the upcoming BOREAS campaigns is complete. An instrument was set up in Harvard Forest from mid-June for three weeks. AVIRIS data were acquired and AVHRR cloud free will be ordered for validation of aerosol retrieval technique. For the SCAR-A (initiated 7/11/93) sunphotometers were installed in the eastern US (Hagerstown Forest, Coyle Field, Pine Barrens, Goddard, Wallops, the Hog Island NSF/LTER site, Hampton Roads, Dismal Swamp) and have

been operating successfully. This effort provides the basis for the MODIS atmospheric correction validation plans.

- AVHRR Calibration: Calibration of the historical data for NOAA 7-9-11 has been completed. Additional data for validation (sunphotometer measurements) are currently analyzed. A paper is in preparation.

- Pre SCAR Field Campaign Preparation.
MAS Data: The MAS Archive was investigated for previous land acquisitions. A series of scenes were selected for evaluation. Software developed to the analyze the Pre-SCAR Experiment data was tested on this archival dataset. Comparisons were made with 6S and LOWTRAN 7 computations.
AVHRR and TM scene were acquired and analyzed for sites where MAS and AVIRIS will be flying during Pre Scar Campaign. Preparations were made to collect airborne sky measurements from light aircraft during the campaign.

• MODIS Land Cover
-The PI attended the IGBP-DIS Land Cover Working Group Meeting held on July 12th.
-Collaborative work is being undertaken with UMd personnel to develop procedures for using time-series AVHRR data to derive land cover classifications for Africa.

• MODIS Fire Detection
- IGBP-DIS Fire Algorithm Workshop (GSFC - February '93)
A workshop was held to review the current status of remote sensing of fires, to develop a community consensus algorithm for fire detection using the AVHRR and to present the plans for the MODIS fire detection.
- SDST initiated a Fire Algorithm prototyping activity applying the current AVHRR algorithm to the first ten days of the IGBP Global data set from EDC.
- The current capability for AVHRR Fire Detection was presented at the IGBP Joint Core Project Workshop on Climate Change and African Savannas in May.
- AVHRR Fire data were processed for the period of the SAFARI Field Campaign in September 1992. The results were presented at the SAFARI results workshop in May.

• MODIS Vegetation Index

- Emphasis for this task has been placed on developing improved procedures for the processing of AVHRR data to generate global NDVI data sets. This activity is in collaboration with Dr N. Saleous with the GIMMS group at GSFC.
- Development of new and improved indices has been the primary responsibility of Dr. A Huete (University of Arizona).

c) Data / Analysis / Interpretation

AVHRR GAC data (GIMMS), LAC data (EDC/South Africa) and subsets of the IGBP Global Data Set were analyzed during the reporting period.

MAS data were analyzed and new AVIRIS and MAS data were collected.

Sunphotometer data continued to be collected at GSFC.

Landsat data were obtained through the EDC MODIS test site initiative. Landsat TM data were acquired through the EOSAT NASA data grant.

MEETINGS ATTENDED

•IGBP-DIS Fire algorithm Workshop (GSFC-Md.)

•MODIS / LTER Meeting (GSFC- Md.)
A workshop was held to strengthen the MODIS /LTER collaboration. MODLAND members attended and there was much discussion concerning the MODIS Test Site Concept and possible areas for near-term collaboration.

•Operationalisation of Remote Sensing (Enschede Holland)
A presentation was made at the above meeting on the need for operational remote sensing for global change. Material on MODIS was included in the presentation.

•Land Processes DAAC Science Advisory Meeting (Sioux Falls SD.)
MODIS was represented at the DAAC bi-annual review.

•Landsat Atmospheric Correction Workshop (Torrance, Ca.)

•The Trace-A/SAFARI results workshop (Stellenbosch, May)

d) Anticipated Future Actions

Research:
Produce and finalize the MODIS ATBD's
Continued AVHRR Fire algorithm study
Continued AVHRR Land Cover study
Continued AVHRR Vegetation Index processing improvements
Continued MODIS Airborne Simulator (MAS) analysis
Analysis of the Pre-SCAR field campaign data
Involvement in implementation of the GSFC Brazilian sun photometer network and data analysis

Upcoming Meetings:
MODIS Team Meeting (October 1993)
NSF LTER All Hands Meeting (September 1993)

Hardware Purchase

- **No new equipment purchased**

e) Problems/Corrective Actions

Nothing to report

f) New Papers

IGBP Fire Algorithm Workshop Report (In Progress)

A paper was presented on aerosol retrieval techniques at the "Landsat Atmospheric Correction Workshop" held in Torrance, California (June 1993).